

## **REMARKS/ARGUMENTS:**

The Office has deemed claims 1 – 14 to describe an invention (Group I) having a classification distinct from the invention described by Claims 15 – 30 (Group II). Applicant has been required to elect between the inventions respective to Groups I and II for further prosecution in this application. Responsively, Applicant has elected to prosecute, in the present application, the Group II invention (Claims 15 – 30). Accordingly, claims 1 – 14 are hereby cancelled. Claims 15 – 30 remain in the application for examination on the merits.

Claims 15 – 21, 27, 29 and 30 were rejected under 35 USC §112 as being indefinite.

Claims 25, 26 and 29 were rejected under 35 USC §102(b) as being anticipated by US 5,046,563 to W.T. Engle et al.

Claims 25, 26, 27 and 29 were rejected under 35 USC §102(b) as being anticipated by US 3,053,182 to G.B. Christopher.

Claims 17, 18, 22 and 28 were rejected under 35 USC §103(a) as being unpatentable over Engle et al in view of US 5,392,684 to S.L. Renfro et al

Claims 15, 16 and 19 – 21 were rejected under 35 USC §103(a) as being unpatentable over Engel et al in view of US 6,634,300 to J.W. Reese et al.

Claims 23 and 24 have been allowed.

Responsive to the Examiner's 35 USC §112 objection to the alternative expression "and/or" used in claims 15, 16 and 19 – 21, those claims have been amended to eliminate the offending expression.

Responsive to the Examiner's 35 USC §112 objection to the "walls" expression used in claims 17, 18, 27, 29 and 30, those claims have been amended to provide a clear antecedent for a single, cylindrical wall.

Responsive to the Examiner's 35 USC §112 objection to the copper percentage expression of claim 19 and the lead percentage expression of claim 20, the claims have been amended to clearly state that the liner mixture includes three elements: tungsten, copper and lead. Of the "copper and lead **portion** of said mixture", claim 19 further describes the "**portion**" as comprising "about 80%"

copper. Claim 20 further describes the “copper and lead **portion** of said mixture” as comprising “about 20% lead”.

Responsive to the Examiner’s objection to Applicant’s nomenclature expression of “80+ %” as used in claim 21, Applicant has amended the claim and the specification to use the alternative expression of **80≥%** to communicate the value range of “about” 80% and above.

Responsive to the Examiner’s objection to the description of housing walls in claim 30 as being “transverse”, Applicant has amended the claim to expand the description of the housing geometry thereby eliminating the offending term. The structure is now described as housing “end walls disposed substantially normal to a cylindrical axis of said housing”.

The Engel et al reference discloses an explosive tubing cutter comprising a pair of conically formed explosive units 40 joined coaxially at their truncated apices against an annular pellet 8 of booster explosive. Base planes of the explosive material cones are formed against annular base plates 50. The base plate of each unit 40 includes an annular neck 52 projecting axially from the conical base plane toward the unit apex and terminates against the booster explosive 8. A fuse 6 extends along a coaxial aperture of the explosive assembly 10.

The explosive assembly 10 of Engel et al is encased within a cylindrical support body 4. The support body includes a cylindrical void volume encompassed by a cylindrical sleeve 12 having an arcuate jet window 18. The void volume is axially delineated by oppositely facing end walls 14 and 16. One explosive unit base plate 50 appears to be spaced from the end wall 14 by an annular structure not specifically described or referenced. The other base plate 50 is seated contiguously against the opposite end wall 16.

The Engel et al support body 4 further comprises a centralizer 28 having a plurality of “flat metal springs 28” secured at one end to the end wall 14 and formed to arc about an axis that is normal to the support body cylinder axis with the free end of the springs extending longitudinally away from the explosive assembly 10.

As amended, Applicant's claim 25 describes a shaped charge tubing cutter having a "**structurally integral**" centralizer comprising a "plurality of planar spring blades, the plane of said blades disposed substantially normal" to the axis of revolution of the conical shaped charge units. Notably, the centralizer 28 of Engel et al is a composite of several separate "flat" spring blade elements. Except at the point of attachment to the Engel et al end wall 14, the "flat" spring plane of Engel et al is not normal to the shaped charge axis. But the point of attachment is not the centralizer "blade". Hence, Engel et al does not disclose a **structurally integral** centralizer having a **plurality of flat blades radiating in a common plane** that is normal to the shaped charge axis.

Applicant's amended claim 26 includes the same distinguishing features over the Engel et al disclosure as explained above with respect to claim 25. Moreover, claim 26 describes the placement of the structurally integral spring blades on the shaped charge housing at a position that permits flexure without engaging housing structure. The Engel et al patent includes no corresponding disclosure or teaching.

Amended claim 29 describes Applicant's cutter assembly as including a shaped charge explosive disposed in a cylindrical housing void space between opposing walls. The opposing walls are described to be substantially normal to the housing axis. The shaped charge explosive unit of the assembly is described as "**separated**" from "**each**" of the opposing walls. Additionally, claim 29 describes a "thrust disc" for co-axially aligning the explosive unit with the housing axis. The Engel et al patent discloses an explosive unit having only one end that is separated from an enclosure wall (14). The opposite end of the Engel et al explosive unit is contiguous with the other housing end wall (16). Clearly, Engel et al were oblivious to the negative consequences of such a arrangement as described in detail by Applicant's paragraph [0009] disclosure. Applicant's paragraph [0033] further expands his assembly details. Applicant's paragraph [0009] disclosure describes a notable loss of cutting capacity in his test experiences with cutters mounted tightly against only one wall of the cutter housing. It appears that coupling the cutter against only one wall of the housing sub causes an asymmetric cutter jet formation.

As a further negative consequence of contiguous engagement of the cutter

against only one sub wall, the asymmetrically formed jet formation increases an undesirable flared distortion of the severed tubing wall in the separation plane.

Applicant's claims 25, 26, 27 and 29 were rejected under 35 USC §102(b) as being anticipated by the Christopher patent.. The Christopher patent describes a well casing cutter that comprises three, frusto-conical shaped charge cutters separated by two frusto-spherical explosive units. Each of the frusto-conical cutters comprises a pair of frusto-cones joined at the truncated apex. The explosive assembly is enclosed within a housing void space between opposing end walls. A plurality of centralizing wires, each secured at one end to the explosive housing, project from the housing at a raked angle to the longitudinal housing axis.

Regarding Applicant's amended claims 25 and 26, the description of a centralizer having structurally integrated, flat spring blades radiating from the housing axis in a common plane clearly differentiates these claims from the prior art of Christopher.

Amended claims 27 and 29 are now distinguished from the Christopher patent by the description of the void space between the housing end walls and the respectively **adjacent ends of the shaped charge joined units** (claim 27). Applicant's "joined unit" comprises a pair of conical explosive units joined at their truncated apices. This description does not relate to the Christopher patent in which only one end of a singular shaped charge unit is separated from an adjacent chamber wall by a void space. The shaped charge "end" that is adjacent the Christopher end wall 56 is **not** joined at the apex with the shaped charge end that is adjacent the opposite Christopher end wall 16. These technical distinctions clearly demonstrate that Christopher had no concept of the objectives served by a void space at between the cutter charge base planes and the adjacent housing end walls.

Amended claims 17 and 18 each describe a pair of nested channels around the inside housing wall opposite from the shaped charge liner. These claims were rejected under 35 USC §103 (a) as being unpatentable over Engel et al in view of Renfro et al. The Renfro et al patent discloses a frangible fastener. Such frangible

fasteners are one-time use elements that secure two bodies together until an abrupt separation is desired. The Renfro et al example of a frangible fastener is a linkage plate having a hollow channel between two attachment flanges. An expansion member enclosing a “mild detonation fuse” is inserted along the hollow channel. Exterior walls of the hollow channel on opposite sides of the attachment flange plane are weakened by fracture grooves 28. Operation of the device comprises an ignition of the detonation fuse 16 to expand the expansion member 10 within the hollow channel. The sudden internal pressure on the walls forming the hollow chamber produces tensile failure in the walls along the fracture grooves 28. Paragraphs [0037] through [[0039] of Applicant’s specification explain the technical reasoning behind Applicant’s nested, internal channel configuration of amended claims 17 and 18. Pointedly, the nested internal channels prevent sonic reflections against the cutting jet as are generated by arcuate windows such as the one disclosed by Engel et al. The Renfro et al disclosure of weakness or separation channels in the exterior surface of a frangible fastener has no teaching relevance to a nested channel configuration to the interior wall of a shaped charge housing to prevent disruption of the charge cutting jet. Hence, amended claims 17 and 18 are clearly patentable over either Engel et al or Renfro et al, considered either singularly or in a teaching combination, one to the other. The patentably novel elements of claims 17 and 18 are taught in neither reference.

Amended claims 22 and 28 are distinguished by structural weakness channels around the shaped charge housing exterior in the **extended base planes** of the explosive cones. More particularly, amended claim 28 describes the housing as having particular structural properties (Rockwell “C” hardness of about 55-60). Original claims 22 and 28 were also rejected as unpatentable over Engel et al in view of Renfro et al under 35 USC §103. Engle et al discloses nothing about exterior weakness channels or grooves in a shaped charge housing. Any **teaching** of such structures to justify the rejection must therefore be derived entirely from the Renfro et al disclosure. However, the Renfro et al invention objectives are vastly different from those of Applicant. Renfro et al discloses a frangible fastener having a single line of

separation on opposite sides of the joinder flange plane. Upon explosive failure, Renfro et al seeks to maximize a separation thrust between the separated elements. Furthermore, the Renfro et al separation thrust is oriented along the fastener flange plane whereby the wall failure stress is tension. The failure stress of Applicant's housing wall is predominately in shear. It is Applicant's objective to shatter the cylinder wall elements between the shaped charge cone base planes into minimal fragment sizes. Preferably, **Renfro et al wants no fragments**: only a clean line of separation. Hence, Renfro et al offers no teaching to the Engel et al disclosure of placing two weakness channels in the exterior housing surface within the explosive cone base planes to shatter the window segment of the housing into many fragments as claimed by Applicant.

Amended claims 15, 16 and 19 - 21 are distinguished by an explosive liner comprising a mixture of powdered tungsten and copper. Amended claim 16 is additionally distinguished by a separation space between housing end wall and the opposite axial ends of the joined explosive units. The original presentation of these claims was rejected under 35 USC §103(a) as unpatentable over Engel et al in view of Reese et al.

The Reese et al patent discloses a shaped charge **perforator** having an explosive liner comprising a mixture of powdered tungsten and copper. As a perforator, the function of the Reese et al device is to perforate (bore/pierce) a small diameter, linear aperture through a steel well casing and into the surrounding earth formation. The disclosed function of Applicant's claimed tubing cutter is to **cross-sectionally sever** a much smaller and lighter pipe or tube segment. Respectively, linear boring and cross-sectional severing are fundamentally distinct functions and geometries. For these reasons, those of skill in the art would **not** look to the pipe perforator arts for improved cutter liner compositions. Applicant is aware of no manufacturer of tubing cutters, other than himself, that has adopted mixtures of powdered tungsten and copper or lead to fabricate the liner of a cutter charge. Shaped charge perforators are substantially **non-analogous art** to shaped charge

tubing cutters.

Although an imperfect analogy, Applicant's and Engel's disclosures correspond to a saw blade whereas the Reese et al disclosure corresponds to a drill bit. Respectively, it is well known that drill bits and saws blades each have distinctive material compositions. A material composition suitable for a drill bit may have little utility as a saw blade and vice versa. For the same reason, those of skill in the art would **not** look to the pipe perforator arts for improved liner compositions with shaped charge tubing cutters. The respective functions and operations are radically different. Hence, there is no obvious teaching of the Reese et al disclosure to the Engel et al disclosure to justify a 35 USC §103(a) rejection of amended claims 15, 16 and 19 - 21.

The Examiner's express allowance of Applicant's claims 23 and 24 is greatly appreciated. It is also noted with appreciation that original claim 30 was rejected only under 35 USC §112 as indefinite. In view of the presently submitted corrective amendments to claim 30, Applicant presumes that claim 30 is also allowable.

In further view of Applicant's amendments of claims 15 - 22 and 25 - 30 to correct the ambiguities noted by the Examiner, and to further differentiate the present invention over the prior art, Applicant respectfully requests the Examiner's favorable reconsideration and allowance of remaining claims 15 - 30.

Respectfully Submitted,



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